REMARKS

Claims 1, 2, 5-7 and 9-23 remain pending in the present application, of which claims 1 and 23 have been amended. Claim 22 has been cancelled without prejudice or disclaimer of the subject matter therein. It is respectfully submitted that the pending claims define allowable subject matter.

Claims 1, 2, 5, 9, 22 and 23 have been rejected under 35 U.S.C. § 103 as being unpatentable over Khutoryansky et al. (USP 5,734,694). Claims 6, 7 and 10-21 have been rejected under 35 U.S.C. § 103 as being unpatentable over Khutoryansky et al. (USP 5,734,694) in view of Tam (USP 5,717,732) and Sata (5,412,702). Applicant respectfully traverses the outstanding rejections for reasons set forth hereafter.

Claim 1 concerns a method for acquiring digital x-ray images and includes "calculating first and second preparation positions for each of said x-ray tube and detector, said first and second preparation positions being located at opposite ends of said scan ranges" and "moving said detector and x-ray tube to said first detector and x-ray tube preparation positions, respectively". A first x-ray image is acquired by moving the detector in a first direction and the x-ray tube in a second direction, the first and second directions being different. After acquiring the first x-ray image, the method includes "moving said detector and x-ray tube to said second detector and x-ray tube preparation positions, respectively". A second x-ray image is then acquired while moving the detector in the second direction and the x-ray tube in the first direction.

In contrast, Khutoryansky specifically teaches "after each tomographic exposure, the system returns to the CENTER position." (col. 8, lines 10-11, emphasis added) Therefore, the system of Khutoryansky does not teach or suggest moving the system to second detector and x-ray tube preparations positions being located at opposite ends of the second scan range with respect to the first detector and x-ray tube preparation positions. Rather, the system always returns to the CENTER position, and no suggestion is made in Khutoryansky to move the system to a position other than CENTER after each exposure.

In addition, the Remote Tomo Control Switch 800 (col. 6, line 22) of Khutoryansky provides the ability to move the tubecrane and bucky into the positions CENTER 802 and HOME 803. CENTER 802 "automatically longitudinally centers the tubecrane and bucky" (col. 6, lines 26-27) and HOME 803 "moves the tubecrane to the HOME (Head End, for example) position and positions the x-ray tube and bucky for the beginning of a linear tomographic sweep" (col. 6, line 28-31). Clearly, only one HOME 803 position is taught, and a second HOME, or starting position, is not suggested. The CENTER 802 position is the position to which the system is returned after an acquisition, as discussed previously, which is different than moving the detector and x-ray tube to second preparation positions as in claim 1.

Furthermore, Khutoryansky does not teach or suggest moving the detector and x-ray tube in different directions while acquiring x-ray images. The Office Action states that "Switches 716 ◄/► specify left or right scanning". Applicant respectfully submits that this assertion is not supported by Khutoryansky in the cited text (col. 4, line 50 – col. 6, line 38) or elsewhere. Although Khutoryansky enables motion of the table bucky and x-ray tube with the motion control switches 716, Khutoryansky does not teach or suggest using the switches 716 to choose or define one or more scan directions for either the x-ray tube or the table bucky (col. 5, line 63 – col. 6, line 19).

Applicant respectfully submits that the system of Khutoryansky teaches the ability to define one starting position, HOME 803, and thus scanning always starts from the one starting position and the detector always moves in the same direction. Furthermore, Khutoryansky does not define more than one scan direction for either the x-ray tube or the table bucky. Therefore, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Khutoryansky to acquire more than one x-ray image in more than one direction.

Claims 6, 7, and 10-21 have been rejected under 35 U.S.C. § 103 as being unpatentable over Khutoryansky in view of Tam and Sata. Applicant respectfully traverses this rejection.

Independent claim 10 includes the steps of "acquiring a series of images with a digital x-ray detector, each image in said series of images corresponding to a slice of interest" and "displaying images simultaneously as each image in said series of images is acquired".

Khutoryansky does not teach or suggest using a digital x-ray detector to acquire a series of images. Khutoryansky also is silent with respect to displaying any images, and thus does not teach or suggest displaying images simultaneously as each image is acquired. Furthermore, it is submitted that the teachings of Tam and Sata, alone or in combination with Khutoryansky, do not make up for the deficiencies of Khutoryansky, and no combination of the three references teaches every claim limitation.

The Office Action states the "Khutoryansky does not detail the structure of his detector, and it would have been obvious to employ therefore any known detector such as the digital detector taught by Tam in order to provide real time display." It is respectfully submitted that Khutoryansky does not detail the structure of any detector because a detector is not utilized in his system. Instead, Khutoryansky uses a table bucky and wall bucky with film to acquire images (col. 1, lines 26-28 and col. 3, lines 60-62). No suggestion is made by Khutoryansky to replace the table and/or wall bucky with a digital detector, such as the digital detector of Tam, for the purpose of providing a real time display, or for any other purpose. Therefore, no motivation exists to combine the two references in this manner.

Additionally, it is submitted that Tam makes only a passing reference to the display 56 and does not teach or suggest the step of "displaying images simultaneously as each image in said series of images is acquired". In Tam, the only reference to displaying images states "Unit 54 places the data in condition for use by computer 48 to generate an image of the object 14, such as by means of display 56." (col. 6, lines 60-63, emphasis added)

Furthermore, there is no suggestion to modify Khutoryansky with Sata, as Khutoryansky uses film and does not use a display. However, if Khutoryansky were modified with the teachings of Sata, the elements of claim 10 still would not be rendered obvious or anticipated. Sata states "It should be understood that according to the present invention, the patient 20 is helically scanned only one time by the X-ray scanner 2 of the first X-ray CT imaging system 100 so as to obtain both of scano data and CT image data." (col. 5, lines 4-8, emphasis added) After the one scan is complete, Sata teaches "processing said selected X-ray projection image data to produce a

scanogram (22) of said helically-scanned biological body (20); and reconstructing an X-ray CT image (21) of said helically-scanned biological body (20) based upon said entire X-ray projection image data, whereby both of said scanogram (22) and said X-ray CT image (21) are substantially simultaneously displayed." (col. 2, lines 32-39) Therefore, Sata clearly states that the images are not displayed as they are acquired, and teaches away from the element of claim 10 of "displaying images simultaneously as each image in said series of images is acquired" (emphasis added).

Claim 6 depends from claim 1 and includes the steps of "displaying said first x-ray image on a monitor before completing said step of acquiring said second x-ray image; and after acquiring said second x-ray image, displaying said first and second x-ray images simultaneously on the monitor in a multi-image format". Claim 7 depends from claim 1 and includes the step of "displaying said first x-ray image on a monitor in a multi-image format display before completing said step of acquiring said second x-ray image". Applicant submits that claims 6 and 7 are not rendered obvious for reasons set forth above, as any combination of the references does not teach or suggest displaying a first x-ray image on a multi-format monitor before acquiring a second x-ray image.

Claim 15 depends from claim 10 and includes the steps of "scanning a patient in a first direction to acquire a first image; and scanning said patient in a direction opposite to said first direction to acquire a second image, said second image being acquired subsequent to said first image." Claim 16 depends from claim 10 and includes the step of "calculating first and second preparation positions located on opposite ends of a scan range over which said series of images of the patient are acquired". Applicant submits that claims 15 and 16 are not rendered obvious for reasons set forth above for claim 1. Additionally, neither Tam nor Sata teach or suggest scanning a patient in a first direction to acquire a first image and scanning a patient in a direction opposite the first direction to acquire a second image. Therefore, neither Tam nor Sata suggests calculating first and second preparation positions located on opposite ends of a scan range. Thus claims 15 and 16 are non-obvious.

It is respectfully submitted that the pending claims define allowable subject matter. Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone number listed below.

Please charge any additional fees or credit overpayment to the Deposit Account of McAndrews, Held & Malloy, Ltd., Account No. 13-0017.

Respectfully submitted,
McANDREWS, HELD & MALLOY, LTD.

Date: December 4, 2002

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APPENDIX

AMENDMENTS TO THE CLAIMS

1. (Twice Amended) A method for acquiring digital x-ray images, said method comprising:

identifying scan parameters designating slices of interest from a patient anatomy;

calculating scan ranges for each of said slices, said scan ranges corresponding to distances traveled by each of a detector and x-ray tube while said x-ray tube exposes said detector to radiation;

calculating first and second preparation positions for each of said x-ray tube and detector, said first and second preparation positions being located at opposite ends of said scan ranges and corresponding to a distance traveled by said x-ray tube and detector, said x-ray tube not exposing said detector to x-rays while moving through said preparation positions;

moving said detector and x-ray tube to said first detector and x-ray tube preparation positions, respectively;

acquiring a first x-ray image with ~~a~~ said detector while moving said detector in a first direction over a first detector scan range and moving said x-ray tube in a second direction over a first tube scan range, said second direction differing from said first direction, said first x-ray image being acquired based on said scan parameters;

moving said detector and x-ray tube to said second detector and x-ray tube preparation positions, respectively ~~based upon said scan ranges for the next said slice~~; and

acquiring a second x-ray image with said detector while moving said detector in said second direction over a second detector scan range and moving said x-ray tube in said first direction over a second tube scan range, said second x-ray image being acquired based on said scan parameters.

23. (~~New~~Amended) The method of claim 1, said calculating step further comprising:

~~calculating first and second preparation positions for each of said x-ray tube and detector, said first and second preparation positions being located at opposite ends of said scan ranges and corresponding to a distance traveled by said x-ray tube and detector, said x-ray tube not exposing said detector to x-rays while moving through said preparation positions; and~~

loading stored x-ray tube angulation data and detector and x-ray tube velocity and travel distances corresponding to a subsequent x-ray image while moving said x-ray tube through said second preparation position.